About the Seawater Desalination Pilot

The Brownsville desal pilot is funded with $1.34 million from the TWDB and $500,000 from the Brownsville PUB, which also is contributing more than $385,000 in in-kind efforts. The plant is located on the Brownsville Ship Channel on land provided by the Port of Brownsville.

The pilot uses a reverse osmosis (RO) process to desalinate water pumped from the channel. The salty water is forced at high pressure through microscopic membranes that filter the salt from the water. The membranes also filter out other particles, including bacteria. The "product" (the pure water) is collected; the "concentrate" (or waste) is disposed of in accordance with environmental regulations. (Details on the process are provided on the reverse.)

The pilot is building on four years of in-depth analyses conducted for the Brownsville PUB with major funding from the TWDB. A feasibility study completed in the fall of 2004 that determined the technical and economic viability of a demonstration project, identified users for the project, and assessed its costs and benefits. Because of urgent water needs and strong regional support, the Brownsville project was only one of three feasibility studies tapped to proceed to the pilot phase.

The pilot will run for 12 months using various technologies to define the most effective and economical process and select components for a full-scale facility. Results to date show that a full-scale seawater desalination plant could be constructed in southern Cameron County by 2010. Current plans call for sizing the plant to produce 25 million gallons per day, enough to satisfy one-third of the total municipal demand projected for the entire county in 2010.

"It is not a matter of whether saltwater will one day be used as an abundant source for public use, but when. As a people, we must have the courage to look into the future and invest today in a better tomorrow. There is no greater untapped source of water than the ocean water which Texas can easily access."

Governor Rick Perry, April 29, 2002

"Seawater desalination . . . holds the promise of providing unlimited supplies of drinking water even during periods of extreme drought. State investment in the Brownsville seawater desalination demonstration project represents a significant step in meeting the future water supply needs of the Lower Rio Grande Valley. It also represents even more significant progress towards meeting the future water supply needs of many regions in Texas."

Texas Water Development Board, 2006 Biennial Report on Desalination

- **Desalinated seawater is the ONLY major new water supply source for the Rio Grande Basin that will provide a consistent, drought-proof supply. There are no other practical alternatives.**
- **Desalinated seawater is the ONLY mechanism that can provide sufficient water to meet growing industrial and municipal water demands while maintaining current supplies for agriculture.**
- **Seawater desalination is the ONLY means of resolving huge water supply deficits in the region now totaling more than 1 MILLION acre-feet of water per year.**

Brownsville Public Utilities Board · Port of Brownsville World Class · NRS engineering better communities

For more information on the pilot project, log on to www.desal.org or call 956-350-8819.
To schedule a tour of the facility, call the Brownsville PUB at 956-983-6292.

Lower Rio Grande Regional

Seawater Desalination Project

SEAWATER FOR THE FUTURE OF SOUTH TEXAS & BEYOND

By 2050, the Lower Rio Grande Valley will need 184,000 acre-feet of NEW water supplies to satisfy growing demands by residents, businesses, and industry. The Rio Grande – already overappropriated – cannot meet the new demand.

There's only one practical solution to this crisis: desalinating seawater from the Gulf of Mexico, an unlimited, drought-proof source of water.

This one solution offers many benefits:
- A desalination plant on the South Texas Gulf coast can meet both local and regional needs.
- A new water supply at the coast means more surface water for upstream users and instream flows.
- Experience with desalination technology can be applied elsewhere in Texas on both seawater and brackish groundwater projects.

The solution is in the works: the Lower Rio Grande Regional Seawater Desalination Project.

Brownsville Public Utilities Board, with funding from the Texas Water Development Board, is piloting the test facility on land donated by the Port of Brownsville. NRS Consulting Engineers is the project engineer and construction manager.

The project promises to revolutionize Texas water markets. New water supplies for coastal communities could stretch existing supplies for more inland users – both municipal and agricultural – and enhance environmental flows.

Realizing the promise of the Brownsville project requires sustained support from all parts of Texas. Continued investment in Texas desalination is critical to turning this pilot into a full-scale plant.

The Right Time & Place for State Desalination Efforts

Technological advancements have sharply reduced the costs of seawater desalination, while the growing numbers of desal facilities worldwide have expanded process and operating knowledge. Some 12,400 desalination plants (developing both seawater and brackish groundwater) operate around the globe. In the United States, projects are underway in Florida and California. The Brownsville facility is the first seawater desalination plant in Texas.

The Rio Grande region is the perfect test case in Texas for seawater as a major new water supply.

The Rio Grande Region

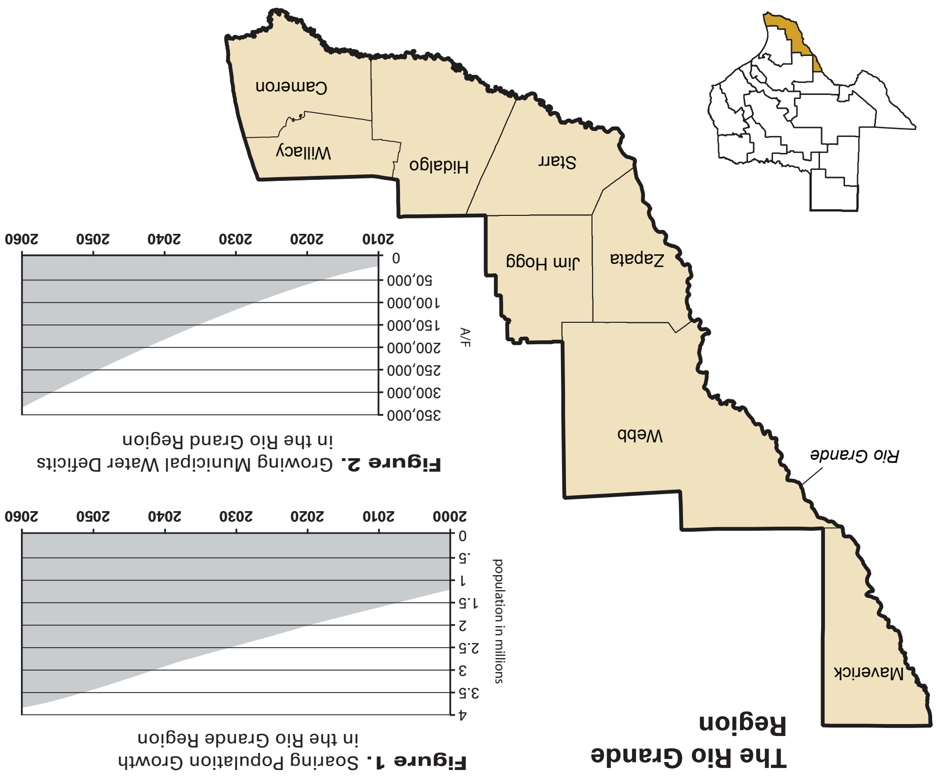


Figure 1. Soaring Population Growth in the Rio Grande Region

Figure 2. Growing Municipal Water Deficits in the Rio Grand Region

Demonstrated Need

Population in the Rio Grande region is projected to more than double over the next 50 years (Fig. 1), fueling increased demand for municipal water supplies (Fig. 2)

The region's primary source of water – the Rio Grande – is overappropriated. Existing supplies from the river are projected to decline more than 25% over the next 50 years, due in large part to sedimentation in reservoirs.

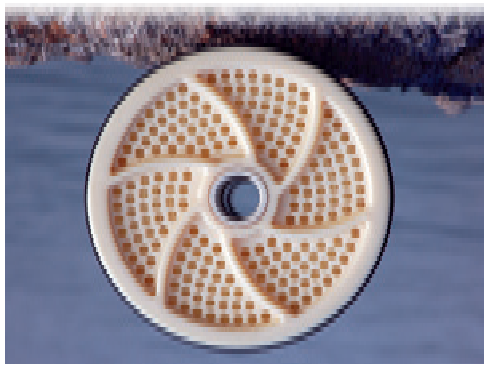
The water deficit in the region already exceeds 1 million acre-feet/year, and only half of the demand for water would be met in drought of record conditions. While the biggest impact is on irrigated agriculture, lower volumes severely compromise the ability of irrigation districts to "push" water for municipal deliveries. Meanwhile, the quality of water available to many users continues to degrade, increasing the cost of treatment. (Source: Rio Grande Regional Water Plan 2006)

New, local water supply options are limited. Brackish groundwater is being developed, but the extent of such reserves is unknown.

Regional Opportunities

The Rio Grande region is unique in Texas in that it has a well established system of water rights. This provides a perfect mechanism for marketing new water produced through desalination.

The project enjoys widespread regional support, from entities such as Rio Grande Regional Water Authority, the Lower Rio Grande Valley Development Council, and 50 other entities representing communities, irrigation districts, and water suppliers. These stakeholders know that an assured water supply is a must for continued economic growth and quality of life.



End cap for reverse osmosis membrane element.

Additionally, the City of Laredo and the Brownsville PUB are exploring options to pipe desalinated water upriver to expand municipal and industrial supplies along the middle Rio Grande.

A seawater desalination facility in Brownsville also could provide a drinking water source for sister cities in Mexico, thus creating larger economies of scale and reducing unit cost.

Desalination not only will benefit municipal and industrial users; it also will have positive impacts for agricultural users and wildlife. Return flows of desalinated water will indirectly benefit the Rio Grande and some of the surface water now used for municipal purposes could be dedicated to environmental uses.

Making Desal a Reality: Continued State Involvement

While the costs of desalination have dropped dramatically, the produced water typically has a price tag that is higher than water delivered from a conventional treatment plant. Ongoing financial assistance has been required for every seawater desal plant built and operated in the United States, primarily to cover energy costs.

The Brownsville PUB is committed to continuing its investment in a secure water supply, but state participation also is needed to bring the plant online.

Project Supporters

Brownsville Economic Development Council
Brownsville Public Utilities Board
Cameron County Commissioners Court
Cameron County Irrigation District No. 2
City of Alamo
City of Alton
City of Brownsville
City of Donna
City of Eagle Pass Water Works System
City of Edinburg
City of Harlingen
City of Hidalgo
City of La Grulla
City of La Joya
City of Laredo
City of Los Fresnos
City of Los Indios
City of Lyford
City of McAllen
City of Palm Valley
City of Penitas
City of Pharr
City of Primera
City of Progreso
City of Rio Hondo
City of Roma
City of San Juan
City of Sullivan City
City of Weslaco
El Jardin Water Supply Corporation
Harlingen CISD
Hidalgo County, Office of the County Judge
Hidalgo MUD #1
Lower Rio Grande Valley Development Council
Maverick County, Office of the County Judge
McAllen Economic Development Council
McAllen ISD
McAllen Public Utilities
Military Highway Water Supply Corporation
North Alamo Water Supply Corporation
Olmito Water Supply Corporation
Pharr-San Juan-Alamo ISD
Port Mansfield
Rio Grande Regional Water Authority
Rio Grande Regional Water Planning Group
San Benito CISD
Southmost Regional Water Authority
Town of Combes
Town of Indian Lake
Town of Laguna Vista
Town of South Padre Island
Willacy County Commissioners Court

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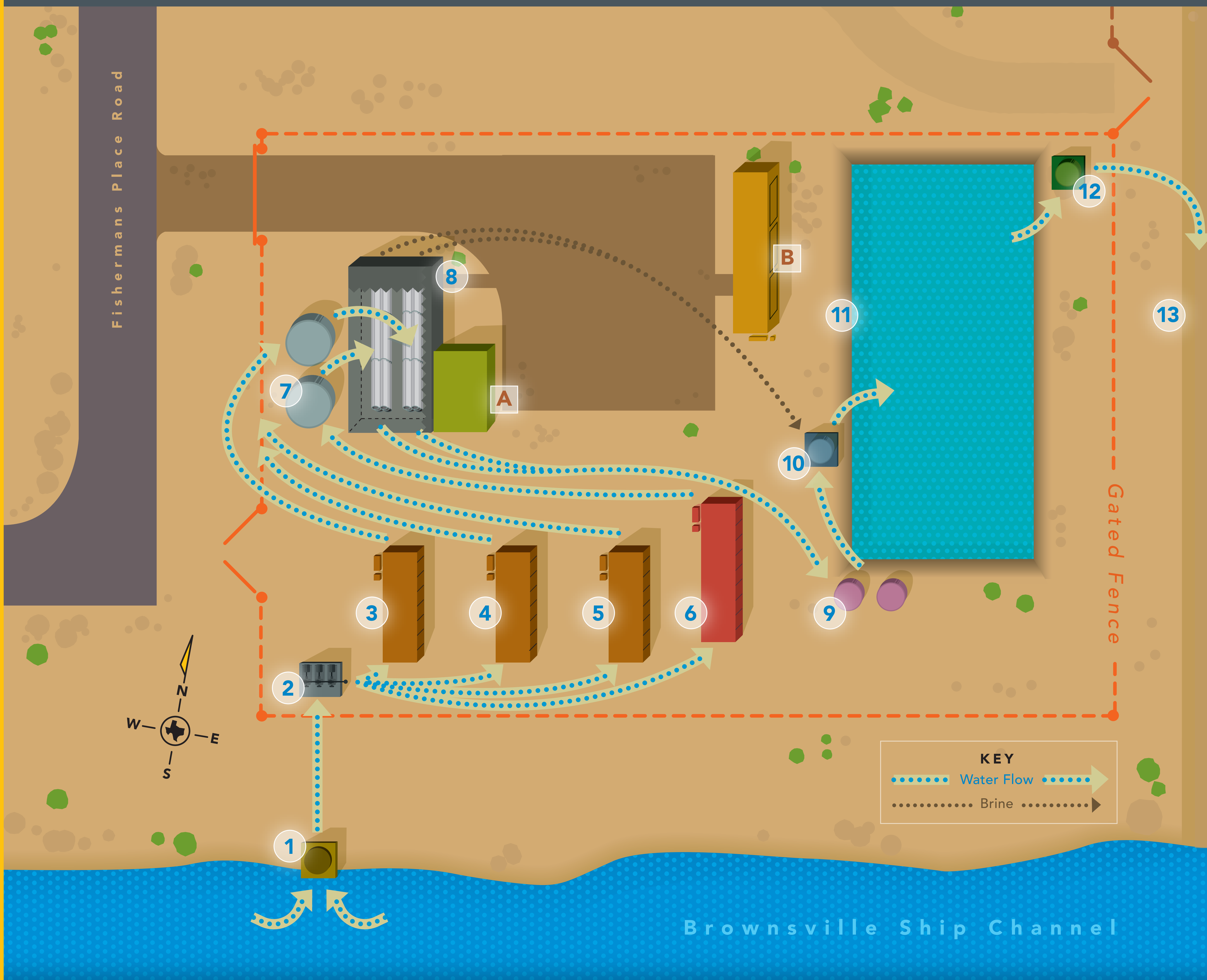
Lower Rio Grande Regional

Seawater Desalination Pilot Facility



WATER TREATMENT PROCESS

1. Intake
2. Intake Pumps
3. Norit Ultrafiltration Pretreatment Unit
4. ZENON Ultrafiltration Pretreatment Unit
5. Pall Microfiltration Pretreatment Unit
6. Eimco Conventional Pretreatment Unit
7. Pretreatment Filtrate Storage Tanks
8. Reverse Osmosis Treatment Facility
9. Water Storage Tanks
10. Mixing Tank
11. Lagoon
12. Neutralization Tank & Discharge Point
13. Discharge Ditch

SUPPORT FACILITIES

A. Chemical Storage Facility
B. Operations Building

Membranes in Brief

The microfiltration (MF) process uses a semi-permeable membrane to trap sus-pended particles, including undissolved solids and bacteria while allowing water to pass through the pores. The pores in an MF membrane range from 0.1 – 1.0 micron in size. (A micron is about a tenth of the diameter of a droplet of mist or fog.)

The ultrafiltration (UF) process uses membranes with much finer pores, ranging from 0.001 to 0.1 micron in size. These membranes allow water to pass through while retaining large molecules, such as solids, bacteria, colloidal material and some viruses.

The reverse osmosis (RO) process uses a selectively permeable membrane that allows water to pass unrestricted but keeps out solute molecules or ions. "Osmosis" refers to the movement of water molecules from an area of high concentration to an area of low concentration.

Turning Seawater into Drinking Water

The desalination process is a multistep procedure. Follow along with the numbered schematic.

First, water collects in an intake well (1) and then is pumped (2) from the Brownsville ship channel into a pipeline that feeds to one of four pretreatment units. These units remove particles suspended in the water: silt, solids, and contaminants. This pretreatment reduces the work required of the critical reverse osmosis (RO) unit that removes salts, significantly reducing costs.

The four pretreatment units differ from one another:

- Two ultrafiltration membrane units (3 & 4) from different suppliers using different technologies;
- A microfiltration unit (5); and
- A conventional treatment unit (6) that uses clarification, sedimentation, and filtration to remove contaminants.

The pilot is testing the various technologies to determine which works most efficiently under the specific conditions existing at the site. For this reason, it also features two parallel trains of holding tanks (7) and RO units (8):

- The water produced from the filtration processes (the "filtrate") is pumped to a holding tank designated only for the UF and MF processes. From there, the filtrate is pumped to an RO unit.
- The water produced from the conventional treatment unit is pumped to a separate holding tank and from there to a separate RO unit.

The RO unit is the key to the desalination process. Here, the water is forced by means of high pressure through fine membranes that keep salt molecules out while allowing water molecules through.

The RO process produces two streams of water: the "product water," cleaned of impurities and salts, and the "concentrate" or "brine," which is the wastewater from the process. The product water is pumped into a holding tanks (9). In an operational plant, the product water would be further treated to ensure good taste and then pumped to homes and businesses. Because this pilot is for testing only, the holding tank is not connected to pipes that carry water to users. Instead, water from this tank is pumped along with concentrate and other water used in operating the facility to a mixing tank (10).

From there, the waters flow to a holding lagoon (11). The water is analyzed to determine its pH (i.e., whether it is acidic or alkaline). The pH is balanced (or "neutralized") (12) and then discharged into a receiving ditch (13), which flows back into the ship channel.